



VOLCANOES!

Volcanic eruptions are among the Earth's most powerful and destructive forces. Imagine hearing a volcano erupt thousands of miles away. Imagine looking through binoculars and seeing the top of a mountain collapse. Imagine discovering an ancient Roman city that had been buried in volcanic ash.

Why Do Volcanoes Erupt?

Deep within the Earth it is so hot that some rocks slowly melt and become a thick flowing substance called **magma**. Because it is lighter than the solid rock around it, magma rises and collects in magma chambers. Eventually some of the magma pushes through **vents** and **fissures** in the Earth's surface. A volcanic eruption occurs! Magma that has erupted is called **lava**.

Some volcanic eruptions are explosive and others are not. How explosive an eruption is depends on how runny or sticky the magma is. If magma is thin and runny, gases can escape easily from it. When this type of magma erupts, it flows out of the volcano. Lava flows rarely kill people, because they move slowly enough for people to get out of their way. Lava flows, however, can cause considerable destruction to buildings in their path.

If magma is thick and sticky, gases cannot escape easily. Pressure builds up until the gases escape violently and explode. In this type of eruption, the magma blasts into the air and breaks apart into pieces called **tephra**. Tephra can range in size from tiny particles of **ash** to house-size boulders.

Explosive volcanic eruptions can be dangerous and deadly. They can blast out clouds of hot tephra from the side or top of a volcano. These fiery clouds race down mountainsides destroying almost everything in their path. Ash erupted into the sky falls back to Earth like powdery snow, but snow that won't melt. If thick enough, blankets of ash can suffocate plants, animals, and humans. When hot volcanic materials mix with water from streams or melted snow and ice, **mudflows** form. Mudflows have buried entire communities located near erupting volcanoes.

Because there may be hundreds or thousands of years between volcanic eruptions, people may not be aware of a volcano's dangers. When Mount St. Helens in the State of Washington erupted in 1980, it had not erupted for 123 years. Most people thought Mount St. Helens was a beautiful, peaceful mountain and not a dangerous volcano.

Where Do Volcanoes Erupt?

Volcanoes occur because the Earth's **crust** is broken into plates that resemble a jigsaw puzzle. There are 16 major plates. These rigid plates float on a softer layer of rock in the Earth's **mantle**. As the plates move about they push together or pull apart. Most volcanoes occur near the edges of plates.

When plates push together, one plate slides beneath the other. This is a **subduction zone**. When the plunging plate gets deep enough inside the **mantle**, some of the rock on the overlying plate melts and forms magma that can move upward and erupt at the Earth's surface. At **rift zones**, plates are moving apart and magma comes to the surface and erupts. Some volcanoes occur in the middle of plates at areas called **hotspots**—places where magma melts through the plate and erupts.

Why Do Volcanoes Grow?

Volcanoes grow because of repeated eruptions. There are three main kinds, or shapes, of volcanoes based on the type of materials they erupt. **Stratovolcanoes** build from eruptions of lava and tephra that pile up in layers, or strata, much like layers of cake and frosting. These volcanoes form symmetrical cones with steep sides. **Shield volcanoes** form from eruptions of flowing lava. The lava spreads out and builds up volcanoes with broad, gently sloping sides. The shape resembles a warrior's shield. **Cinder cones** build from erupting lava that breaks into small pieces as it blasts into the air. As the lava pieces fall back to the ground, they cool and harden into cinders that pile up around the volcano's vent. Cinder cones are very small cone-shaped volcanoes.

On May 18, 1980, Mount St. Helens violently erupted. For 2 months the volcano showed signs that it was waking up from its 123-year sleep. Earthquakes beneath the mountain increased. Steam and ash erupted. And a "bulge" grew on the mountain's steep north side. All these warning signs signaled that magma was moving upward inside the volcano.

The First 35 Seconds

On the morning of the eruption, Gary Rosenquist was camped about 36 kilometers (11 miles) from the summit of Mount St. Helens. Another camper was looking through binoculars and noticed that the upper right side of the volcano looked "fuzzy." He shouted that the "mountain was going." Rosenquist began taking photographs.

An earthquake that occurred beneath the volcano shook loose the "bulge" on the mountain's steep north side. Rock and ice slide down the mountain. Then the mountain exploded gases, magma, and water laterally out the side where the "bulge" had been. The explosion hurled hot rock and ash at hurricane speeds. Ash and steam erupted vertically from the volcano's **crater** and continued for 9 hours.

The Mountain Blows its Top

Volcanic eruptions alter the surface of the Earth's lithosphere, the hard, outermost shell of the Earth. Many eruptions have built Mount St. Helens' beautiful cone shape. The May 18, 1980, eruption, however, dramatically changed the volcano's size and shape. It tore off the mountain's top and blasted a giant crater in its side.

Smaller eruptions have continued since 1980. Mostly occurring on the bottom of the volcano's crater, each eruption squeezes up thick, pasty lava and sometimes spews out tephra. In the photograph on the right, look for the **dome** that has formed inside the crater. Slowly, the volcano is rebuilding itself into its former shape.

Up in the Air

Volcanoes erupt materials into the atmosphere, the gases and water vapor that surround the Earth. The eruption blasted ash and gases into the atmosphere. Winds carried ash great distances. The ash-covered truck shown here was parked 19 kilometers (12 miles) from Mount St. Helens. Two men who were camped nearby died, suffocating from hot volcanic ash. They were two of 57 known fatalities.

In Yakima, a city in eastern Washington, ash began to fall about an hour after the eruption. It became so dark that lights were turned on all day. Face masks were necessary when people went outside. It took 10 weeks to haul away the ash from Yakima's streets, sidewalks, and roofs.

Water, Rock, and Mud

The hydrosphere—the liquid water on and under the Earth's surface—can make volcanic eruptions more dangerous. Before the May 18, 1980, eruption, the streams on Mount St. Helens were crystal clear. After the eruption, streams were choked with rock and mud. When water mixed with rock and mud, it created volcanic mudflows (also called lahars) that were able to move down the volcano's slopes. On the steepest slopes, the mudflows traveled up to 144 kilometers per hour (90 miles per hour). Some of the mudflows were as high as a six-story building!

Fire and Ice

Ice and snow—the part of the Earth system called the cryosphere—can melt during a volcanic eruption. Snow- and ice-capped volcanoes like Mount St. Helens are especially dangerous if they erupt. Much of the water in Mount St. Helens' mudflows came from snow and ice melted by the heat of the eruption. These mudflows were as thick as wet cement and able to carry along almost anything that they picked up. Eyewitnesses reported seeing mudflows carry everything from farm animals to a fully loaded logging truck. Fortunately, when the mudflow hit, no one was in the bus pictured here.

Death and Recovery

The Earth's biosphere—the realm of all living things—is affected during a volcanic eruption. The force of the eruption on Mount St. Helens blew down giant trees like they were match sticks. Almost all of the animals that lived in these forests were killed as well. Birds were particularly hard hit. Some birds survived the eruption but died later because the insects and plants they ate had died.

Surprisingly, some plants and animals did survive. Plants sprouted from roots that survived even though the plants' tops had been sheared off. Animals such as gophers and ants survived in their underground homes. Within a few weeks of the eruption deer, elk, and other animals moved in from nearby areas to take advantage of the new plants that were sprouting.

Volcanoes are also creative forces. The Earth's first oceans and atmosphere formed from the gases given off by volcanoes. In turn, oceans and an atmosphere created the environment that made life possible on our planet. Volcanoes have also shaped the Earth's landscape. Many of our mountains, islands, and plains have been built by volcanic eruptions.

